CARB Air Quality Data, Vol. I – see enclosed CD

Note:

A CD with data from the California Environmental Protection Agency, Air Resources Board, was included as a reference. The CD contains more than 600 megabytes of data. A label on the CD has the following information:

Planning and Technical Support Division
Air Quality Data Branch
Community Assessment & Statistical Analysis Section

CALIFORNIA AMBIENT AIR QUALITY DATA
1980-2004

2006 Air Quality Data CD 1 of 2
January 2006

CD number PTSD-06-021-CD

Annual Data Program Installation & Hourly, Daily, Annual Data

One of the files on the CD is a 16-page PDF document named "READMECD.pdf." It describes the information contained on the disk, and it is reprinted on the following pages.

Use of the CD requires a computer with Windows 95 or higher. The CD contains an installation program for viewing the data using the ACCESS 2000 Runtime program.

A copy of the CD may be requested from:

California State Lands Commission
Division of Environmental Planning and Management
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

or by email at:
sanderd@slc.ca.gov

It is also available for review at: Ecology and Environment, Inc., 130 Battery Street, 4th Floor, San Francisco, CA 94111, (415) 981 2811.

California Environmental Protection Agency
Air Resources Board
Planning and Technical Support Division

January, 2006

Data CD Numbers: PTSD-06-021-CD; PTSD-06-022-CD

CONTENTS OF THIS README FILE

I. Introduction

These CDs were produced by the California Air Resources Board, Air Quality Data Branch, Community Assessment and Statistical Analysis Section. The CDs contain California ambient air quality data for criteria pollutants for 1980 through 2004, toxics' pollutants for 1990 through 2004, dichotomous sampler (Dichot) data for 1988 through 2001, and non-methane organic compound (NMOC) data for 1994 through 2004.

Criteria data include hourly and daily values as well as annual summaries. Toxics data include daily values and annual summaries. Dichot mass and speciation data include only daily values. NMOC data are 3-hour samples. Data are provided for each monitoring site, and are also summarized at the air basin and statewide maximum levels for most data except for the hourly data.

These CDs are the result of our continuing efforts to make air quality data available to users and clients in convenient electronic form. This is our ninth annual release of an air quality data CD to the general public (the first release of the

CD was in December 1997). The following is a selected list of our Internet sites that provide related information:

- More recent data
  http://www.arb.ca.gov/aqd/aqd.htm
- The Air Quality Today page provides near real time air quality data and meteorological data for California.
  http://www.arb.ca.gov/aqd/aqinfo.htm
- California Air Quality Data - Selected Data Available for Download (Errata for the 2006 Air Quality Data CDs are listed)
  http://www.arb.ca.gov/aqd/aqdcd/aqdcddld.htm
- Query Tool to Identify Changed Historical Air Quality Data
  http://www.arb.ca.gov/aqmis2/changed_data.php
- U.S. EPA Federal Non-attainment Areas
  http://www.epa.gov/air/oaqps/greenbk/
- Quality Assurance Programs
  http://www.arb.ca.gov/aaqm/qmosqual/qmosqual.htm
- Air Monitoring Network Information
  http://www.arb.ca.gov/aaqm/mldaqsb/amn.htm
- Quality Assurance Monitoring Site Information
  http://www.arb.ca.gov/aqdas/siteinfo.htm

II. What's Featured on these CDs?

We added a few new features to this year's CDs. Some of the more notable are summarized below:

There are two CDs this year. Both CDs contain all the documentation. The CD number PTSD-06-022-CD contains only the Dbf data files necessary to operate the “Daily Data” program. The remainder of the data files are on the CD number PTSD-06-021-CD. The CD number PTSD-06-021-CD contains the installation program for the “Annual Data” using the ACCESS 2000 Runtime program.

2004 Data:

- We have updated all the files to include 2004 air quality data.
- Daily criteria pollutant data now cover the period 1980-2004.
- Hourly criteria pollutant data now cover the period 1980-2004.
- Toxic pollutant data now cover 1990-2004.

We have added daily and annual ozone summarized data by ozone 8-hour planning area to the CDs. These ozone data are available in the “Daily Data” and “Annual Data” programs.

We have created a new “Annual Data” program that uses the Access 2000 Runtime software that must be installed on your computer. The CD number PTSD-06-021-CD includes the installation instructions and software installation routine.

The new “Annual Data” program has three added reports based on the ozone 8-hour planning areas for a total of 12 report types.

The “Enhanced Annual Data” program from last year had nine types of reports available.

The “Daily Data” program will now run off the PTSD-06-022-CD or it can be downloaded to your hard drive at C:\Dbf2006CD\. The hard drive installation gives a quicker data response time.

We have added the start hour of the ozone daily 8-hour maximum and the hour of the ozone daily 1-hour maximum at each site. These additions are available in the Dbf files and in the “Daily Data” program.

The site-based hourly TEOM and PM10 BAM data have been removed from the HRPMxxxx.dat files for all years. The TEOM and PM10 BAM data are available on the PTSD-06-021-CD in the \Comma\ directory.

We have added an Internet link for a “Query Tool to Identify Changed Historical Air Quality Data.” http://www.arb.ca.gov/aqmis2/changed_data.php

We have added an Internet link to the “U.S. EPA Federal Non-attainment Areas” http://www.epa.gov/air/oaqps/greenbk/ Select the 8-hour ozone link, and under the “Nonattainment Area Selections“, select “Sorted by State/Area/County” and California: http://www.epa.gov/air/oaqps/greenbk/gncs.html#CALIFORNIA This link will list the 8-hour ozone federal non-attainment areas which are included on the CDs as ozone 8-hour planning areas.

Some of the more notable features added previously are summarized below:

Site-based annual statistics for PM10 and PM2.5 are based upon daily and hourly monitor-based data. For national statistics, the primary nationally approved monitors are used to calculate statistics. For State statistics, the maximum value of the California approved monitors at each site is used, but the specific monitor is dependent on the statistic.

State site-based “Top 4 Values” for PM10 and PM2.5 are based on the maximum value and the following “Top 4” from that one monitor for each site, respectively. National site-based “Top 4 Values” for PM10 and PM2.5 are from the primary monitor at each site, respectively.

Daily and hourly data for PM10 and PM2.5 are monitor-based and are available in comma-delimited and EXCEL format on the PTSD-06-021-CD in the directory called \Comma\ by using Windows Explorer. The PM10, BAM-based PM10, TEOM-based PM10, and PM2.5 daily data are not available in DBF format or through the "Daily Data" program. The comma-delimited PM10 and PM2.5 monitor based files now have two new fields: collection methods and quantification methods. Text files listed on the PTSD-06-021-CD

in the \Comma\ directory define these two new fields. The collection methods for PM10 SSI samplers are denoted by methods beginning with “HV” or method codes: BGPQ2, RP225, and RP2K.

New Particulate (PM10, PM2.5) annual summaries – please review the\Doc\File06cd.pdf to determine the summary type of each statistic. There are both State and National statistics. The underlying particulate data are monitor-based instead of site-based. For example, where two or more monitors measure a pollutant at the same location, the data are reported separately for each monitor.

The “Outside of California” air basin has been added to the “Annual Data” reports. The “Outside of California” air basin contains only Nevada monitoring sites and can be selected using the basin pull-down menu on the “Annual Data” program. The summaries for the “Outside of California” air basin are not included in the whole State option, since the air quality data monitoring was performed outside of California.

III. Auto-Start in Windows 95 or later

To run the CD under Windows 95 or later, simply insert the CD in your computer, close the drawer, and the CD will auto-start. If the CD is already in the drawer, you can open and then close the drawer or use Windows Explorer and click on STARTUP.EXE in the root directory of the CD drive. You can also use STARTUP.EXE if you have deactivated the auto-start capability on your computer.

We are not supporting running the CD under Windows 3.1x. Windows 3.1x will not run the programs on this CD, but the ASCII files and the DBF files can be retrieved from the CD.

Throughout this README document, we assume that your CDROM drive is your D: drive. Please substitute whatever drive letter is appropriate for your computer.

The screen that you see on startup will be referred to as the "startup screen." On it you may choose one of the buttons ("Hyperlinked", "Plain Text", "Install Annual Data", or "Daily Data on CD"). Some of these buttons have pull-down menus to provide additional selection. To exit the startup screen, click on the "Exit" button.

IV. Annual Data

The CD number PTSD-06-021-CD contains annual criteria pollutant and toxics summary data in ACCESS version 2000 databases, YRLYACC2 and YRLYAC2H, under the primary directory C:\AQDCDAC3. YRLYACC2 contains annual summary information for both criteria

and toxics air pollutants. ACCESS is a registered trademark. The Access 2000 runtime software and the ACCESS databases need to be installed on your computer from the CD number PTSD-06-021-CD. **A printer must be installed on your computer in order for this software to run, but the printer does not need to be connected.** Please refer to the instructions on this CD for installation procedures on a Windows XP operating system. After installing the ACCESS programs, from the Windows "start" button, open "programs", and select "2006 Air Quality Data CD – Annual Data – Access 2000 Runtime."

In order to make your existing ACCESS program the default for all ACCESS databases, after each time that you close the ACCESS 2000 runtime program, you need to open your existing ACCESS program (with or without a database) from the Windows program menu.

Opening the "2006 Air Quality Data CD – Annual Data – Access 2000 Runtime" program will provide a selection list with 12 options:

1. Run Criteria Pollutant Summary - 1 Pollutant, Multiple Variables -- This option allows the user to produce annual summary reports for any of seven criteria pollutants (CO, H2S, NO2, OZONE, PM10, PM2.5, and SO2). Each report produced contains data for several variables for the specific pollutant.

2. Run Criteria Pollutant Summary - 1 Pollutant, 1 Criteria Variable -- This option allows the user to pick any of the criteria variables in the database and see a report of values for the variable for either 1995-2004 or 1984-2004.

3. Criteria Pollutant Summary - 6 Variable Choice -- This option allows the used to produce annual summary reports for up to six criteria variables in the database for the range of selected years and locations.

4. Run Criteria Pollutant Summary -Top 4 Values – This option allows the user to pick a pollutant-averaging time combination and see the Top 4 daily maximum values and corresponding dates of occurrence for the range of years the user selects.

5. Run Monthly Criteria Pollutant Summary -- This option allows the user to pick from a selection of criteria variables in the database and see a report of the monthly values for the variable for the range of years the user specifies.

6. Run Toxics Summary - 1 Toxics Compound -- This option allows the user to run a summary of any of the 72 toxics compounds in the database and see a report of values for the compound for the range of years the user selects. All reports contain summaries for California. The user can choose to include details for individual monitoring sites. Familiarity with monitoring site details is recommended to better understand

trends for the compound at the statewide level.

7. Toxics Summary - 6 Compound Choice -- This option allows the user to select one annual toxics statistic (e.g. annual average, 90th percentile, or median) and up to six toxics compounds for comparison on the same report.

8. Run Data Availability Summary -- This option allows the user to run a summary of the availability of gaseous or particulate pollutant data for a range of years the user selects. The data availability summary does not include PM2.5 BAM hourly data. The user may also run detailed year by year summaries for individual pollutant groups or subgroups.

9. Run Data Change Summary -- This option allows the user to run a summary indicating the most recent date of change to various pollutant data in the state air quality database. The user specifies a date after which the changed data are identified. This summary may be particularly useful to users who have used data from a previous CD or data extraction from the state database. It can be used to identify if there were updates to the data obtained previously. A data change summary can be produced for gaseous or particulate pollutant data for a range of years the user selects. The user may also run detailed year by year summaries for individual pollutant groups or subgroups.

10. Run Ozone 8-hour Planning Area Summary - Multiple Variables -- This option allows the user to produce annual summary reports for ozone. Each report produced contains data for several variables for the ozone.

11. Run Ozone Summary -Top 4 Values in the 8-hr. Planning Areas – This option allows the user to pick a pollutant-averaging time combination and see the Top 4 daily maximum values and corresponding dates of occurrence for the range of years the user selects.

12. Run Monthly Ozone Summary (8-hr Planning Areas) -- This option allows the user to pick from a selection of ozone variables in the database and see a report of the monthly values for the variable for the range of years the user specifies.

These options can be used to produce either reports that can be printed directly or worksheets that extract the information used in the reports. Users who want to use these data in spreadsheets can create a worksheet, and then copy the result into their Windows clipboard and then paste it onto their spreadsheet.

When you have finished running the reports or worksheets of interest, press the "Quit" button to end the program.

V. Daily Data

The “Daily Data on CD” button on the startup screen allows you to display, print or export daily data. Pressing the “Daily Data on CD” button brings up a data selection screen.

On Windows ME, the “Daily Data on CD” button does not work. To use the “Daily Data”, copy the whole DBF folder to the root directory of your hard drive, provided there is sufficient space (650 Mb), and double click on the file C:\Dbf2006CD\dlyrvfp5_2006AQDCD.exe.

Use the following procedure to make your data selection from the “Daily Data” program:

1. Choose Pollutant Category - You may select criteria gas data, criteria particulate data, dichot data, toxics data, or ozone 8-hr planning area data.

2. Select Desired Output - You may choose printable report, a data file with 1 variable, a data file with two to six variables, or a data file with all variables. If you choose printable report, you have the option to view the data, print it or export it in the general structure that it is displayed. If you export data, read the section below titled, “Using Numbers Stored As Text".

3. Select Variable - If you selected printable report or data file with one variable, then select the variable you want as output. If you chose other data file options, you do not need to select a variable.

4. Select Range of Years - Pick the start year and the end year for which you want data.

5. Select Geographic Scope - You have a choice of statewide or data for a single area. If you opt for a single area, select the area of interest from the pull-down list.

6. Select Level of Detail - You may choose to see only State and area summary data or to see data from individual monitoring sites as well as the summary data.

7. Location Selection - You may choose to see all locations within the defined geographic scope or select those locations to be displayed or retrieved.

8. Run Selection - After making the above selections, choose “Run” to continue with your selection. If you chose to output 2 to 6 variables, you will be first asked to select the variables. If you specified a desire to select locations, then you will have an option to select the locations to be included.

If during your work session, you have previously selected locations, you will have the option to initialize your list of selections with your prior choice. If your prior choice included locations outside the current geographical scope, they would still be on the initialized selection list until removed.

Before a report or file is produced, you are notified as to the number of expected pages or the number of monitor locations included. After seeing this estimate, you have the option to cancel your request. If your report would exceed 200 pages, your request is automatically canceled and you are notified of the page estimate and asked to narrow the scope of the report.

If you are producing a file, you are asked whether to include descriptive labels in the file. Including descriptive labels can greatly increase the size of the file and is not recommended if you are selecting many locations or many years of data.

If you are producing a comma delimited or fixed format file, you have the option to also produce a corresponding ".FMT" file describing the file structure. If you are producing an Excel (.XLS) file and the file would exceed 16,384 rows, then a "DBF" file is produced instead. Excel or Quattro Pro can load "DBF" files up to the capacity of the spreadsheet program.

When you have finished running the daily reports or extractions of interest, press the “Exit” button to return to the startup screen.

VI. Documents Available

Information on Documents available on this CD can be obtained by pressing the “Hyperlinked” or "Plain Text" button on the startup screen. This brings up a pick list that includes the following categories:

- Readme - Overview of CD
- Data Files/Formats
  - Information on ACCESS Files
  - Information on Comma Delimited Files
  - Information on DBF Files
  - Information on Fixed Format Files
  - List of Data Files on CD
- Glossary
- NMOC Data and PAMS Sites
  - NMOC Data
  - PAMS Monitoring Sites
  - NMOC – Limits of Detection
- Toxics
  - Benzene and 1,3-Butadiene Adjustments
  - Use of ARB's Ambient Toxics Data
  - Levels of Detection - ARB Data
  - Levels of Detection - District Data
  - Toxic Air Contaminant List

  - TAC Substance by Category
- Air Monitoring Program
  - Summary of California Program
  - Data Quality Information
- Air Quality Standards
- Useful Internet Links

VII. Data Formats Available

This CD-ROM includes data in the following formats:

ASCII FIXED Format - All hourly and daily, and some annual data are available in ASCII fixed format and are located under the main directory \FIX_FORM\ on PTSD-06-021-CD. The fixed format files have a "DAT" or "EXE" suffix. Hourly and daily "DAT" files are compressed into self-extracting "EXE" files. To uncompress them, copy them to your hard drive and then execute (run) the "EXE" file. File formats for the fixed format files have a "FMT" suffix and are located with the data files. Additional information on the fixed format files is included in the file "FIX_INFO.PDF" located in the DOC directory of the CDs, or by pressing the "Plain Text" button.

COMMA Delimited ASCII Format - PM10, PM2.5, and Dichot daily data files, and PM10 and PM2.5 hourly data files are available in comma delimited ASCII format and located under the main directory \COMMA\ on PTSD-06-021-CD with a "TXT" or “EXE” suffix. The first line of each file contains labels for the data in the files. Additional information on the comma delimited ASCII files is included in the directory \DOC\file06cd.pdf or by pressing the "Plain Text" button.

DBF Format - Daily and annual data are available in FoxPro 2.X DBF files, which have corresponding CDX index files. The DBF files, although developed in Foxpro 2.X, can be easily read or imported by many database and spreadsheet programs, including ACCESS, PARADOX, FOXPRO, QUATTRO PRO, SAS, and EXCEL (The product names may be registered trademarks). The DBF files are located in the main directory, \DBF\. Additional information on DBF files is included in the file "DBF_INFO.PDF" located in the DOC directory of the CD, or by pressing the "Plain Text" button. Numerical data in the DBF files are stored as text to ensure proper interpretation of null values (see note in Section XII).

ACCESS - Microsoft ACCESS version 2000 databases, YRLYACC2 and YRLYAC2H, can be installed on your C:\aqdcdac3 using the installation program on PTSD-06-021-CD. Additional information on the ACCESS database is included in the file "ACCESSDB.PDF" located in the DOC directory of the CD or by pressing the "Plain Text" button.

A detailed listing of files and their formats is included in a separate file, FILE06CD.PDF in the \DOC subdirectory, or by pressing the "Plain Text" button.

VIII. Organization of Data on This CD

The directories on this CD are:

```
     COMMA      -  Contains All Comma Delimited Files(021-CD only)
     DBF06_B    -  Contains Some DBF Files (PTSD-06-021-CD only)
     DBF2006CD  -  Contains Some DBF Files (PTSD-06-022-CD only)
     DOC        -  Contains Documentation (Both 021 and 022 CDs)
     FIX_FORM   -  Contains Variable and Location (021-CD only)
          DAILY   -  Contains Daily Data
          HOURLY  -  Contains Hourly Data
          YEARLY  -  Contains Annual Data
     HTML       -  Contains HTML & PDF Files(Both 021 and 022 CDs)
     INSTALL_PACKAGE - ACCESS 2000 Runtime (021-CD only)
```

IX. Data Limitations

The data on this CD were copied from the ARB air quality databases while the databases were frozen on August 29, 2005, except for the 2004 3-hour NMOC (PAMS) data from the Sacramento Metropolitan Air Quality Management District (SMAQMD). Thus, most of the data on this CD represent data in the State database as of August 29, 2005. The 2004 3-hour canister NMOC (PAMS) data for SMAQMD were extracted from our database on November 22, 2005.

The CD does not include data submitted to the state or national air quality database (AIRS) after August 29, 2005. In some cases, data providers had not provided complete data for 2004 by August 29, 2005. In order to verify that the monitoring sites were operating in 2004, the following Internet link to the “State and Local Air Monitoring Network Plan” may be helpful. http://www.arb.ca.gov/aqd/namslams/namslams.htm

The State and Local Air Monitoring Network Plan provides a wealth of information about ambient air quality air monitoring sites in California and the northern Baja California portion of Mexico. The monitoring sites in the network include instruments that measure ambient levels of gaseous and particulate air pollutants, and in some cases, meteorological parameters. Table 1 of the report includes the range of years for which air quality monitoring data are available for each pollutant at each site. Table 1 now indicates whether real-time data are available for a monitor.

The criteria for determining data representativeness can be important, especially for data analyses in making regulatory

decisions. In general, air quality measurements and statistics are considered representative if a minimum of 75 percent of all the potential short term values are included and are distributed throughout the entire statistical time period. This 75 percent criteria must be met from the averaging time of the initial measurement, up to and including, the final averaging time reflected by the air quality measurement or statistic. For example, a daily statistic must be based on data that meet the representativeness criteria specified for a "Day." This is especially important when comparing daily averages. To illustrate, daily values for PM2.5 can be based on a single 24-hour sample (filter-based instrument) or on 24 separate hourly measurements (e.g., BAM instrument). In the latter situation, a daily value would not be valid if less than 18 of the 24 hours were represented by measured data. Because a statistic reflects a specific time period, the data need to meet the representativeness criteria for the same time period (Day, Month, Quarter, or Year). In evaluating data representativeness, all measurements are considered, including those identified as affected by a highly irregular or infrequent event. The "Criteria for Representativeness of Air Quality Measurements and Statistics" are found on the Internet site in "Attachment A: Proposed Amendments to the Area Designation Criteria." http://www.arb.ca.gov/desig/desig03/desig03.htm

The PMFINE (PMF) data found on this CD were collected using a dichotomous sampler, which is not an official method to determine National PM2.5 standard exceedances. Official data are identified as PM2.5 and "PM25", rather than PMFINE; these data start in late 1998.

Some PM10 data on this CD are expressed under both local and standard atmospheric conditions. In the data records for 1997, there are local data available for 5 sites in the South Central Coast Air Basin: El Capitan Beach (2008), Las Flores Canyon #1 (3101), Las Flores Canyon #2 (3102), Lompoc-S H Street (2360), and Vandenberg Air Force Base-STS Power (3023). Before 1998, most of the PM10 data were expressed under standard conditions. For 1998 and later, data for all sites, except for those only in the South Coast Air Basin, Palm Springs, and Indio, are expressed under both local and standard conditions. The local data record for South Coast Air Basin, Palm Springs, and Indio is included, but it starts with 2002.

The PM10 state and national statistics listed on this CD, except for sites noted above, may differ from each other because 1998 and later state statistics are based on data expressed under local conditions. In addition, national statistics are listed only for those monitors that use federal reference or equivalent methods and state statistics are listed only for those monitors that are California Approved Samplers.

Similarly, national statistics for PM2.5 are listed only for those monitors that use federal reference or equivalent methods,

while state statistics are listed only for those monitors that are California Approved Samplers. Hourly PM2.5 data availability are not included in the "Annual Data" reports.

We would like to clarify the usage of PM10 data to calculate EPDCs. Site PM10 EPDCs for all areas of the state are based on local conditions data except for data prior to 2002 for the South Coast Air Basin, Palm Springs, and Indio. The basin PM10 EPDCs for all areas of the state are based on local conditions data except for data prior to 2002 for the South Coast Air Basin. Salton Sea Air Basin PM10 EPDCs are based on those sites that produce local conditions data. Even though we report standard conditions data for Indio and Palm Springs, those results are not included in the maximum PM10 EPDC for the basin. If the sites in the southern Salton Sea Air Basin had enough data to be valid for 1998 and 1999, the PM10 EPDCs would have been higher than those from Indio.

The BAM-based PM10 and TEOM-based PM10 hourly data and daily averages from the monitor-based data are available by using Windows Explorer to locate the files called PM10stdhourly.exe, PM10localhourly.exe, PM10stdhourlydailyavgs.exe, PM10localhourlydailyavgs.exe, and PM10stddaily.exe in the directory called \Comma\ on the PTSD-06-021-CD.

Since we took a snapshot of the ARB database, there some data that were not possible to correct prior to the database extraction on August 29, 2005. The CO hourly data at the El Centro site in Imperial County are still being reviewed and investigated, beginning in April 2003 to December 31, 2004. Some data were determined to be invalid after the extraction on August 29, 2005 and have been deleted from our database, but these data are still on these CDs. The following is a list of deleted data since August 29, 2005 as of December 6, 2005:

- For Ozone: Sequoia National Park-Lookout Point (3206) data between 1/30/04-2/2/04
- For PM2.5 filter-based: Santa Cruz-2544 Soquel Ave. (3200) data between 12/17/04-12/31/04
- For SO2: North Highlands-Blackfoot Way (2123) data between 11/24/04-11/29/04
- For PM10 filter-based (standard and local conditions):
    - Westmoreland-W. 1st St. (3143) data between 1/28/04-4/21/04
    - Brawley-220 Main St. (3675) data between 1/28/04-4/15/04
    - Calexico-Grant St. (2997) data between 1/28/04-4/21/04
    - El Centro-9th St. (2551) data between 1/13/04-4/21/04
    - Niland-English Rd (3186) data between 1/22/04-4/15/04
    - Ridgecrest-Las Flores Ave. (3122) data between 1/10/04-4/3/04
    - Yuba City-Almond St. (2958) data between 2/27/04-5/21/04
    - Colusa-Sunrise Blvd (2744) data between 2/15/04-5/15/04
    - China Lake-Powerline Rd. (2774) data between 1/10/04-5/12/04

- Quincy-N Church St. (3020) data between 12/29/03-3/28/04
- South Lake Tahoe-Sandy Way (2948) data between 3/4/04-6/2/04

The NOx levels for the SB 25 Crockett (1098 Pomona Street) site in the San Francisco Bay Area Air Basin from October 4, 2001 to February 28, 2002 do not equal the sum of NO and NO2 levels. Mathematically, the NOx should equal NO + NO2. Crockett, being adjacent to large bodies of water, may have been prone to detector moisture interference, which could explain these readings. These NO, NO2, and NOx data that were provided on these CDs have not been corrected for this time period. NOx levels after February 28, 2002 at Crockett appear to follow this summation of NO + NO2 levels.

Viewers who intend to use the toxics data on this CD should read the background notes on the use of ARB's ambient air quality data. These notes can be found in text files CAUTIONS.PDF, ARB_LOD.PDF, and QA.PDF, which are located in the D:\DOC directory, or available by pressing the "Plain Text" button. Information on changes in benzene and 1,3 butadiene measurement methods and the implication of such changes can be found in the file \DOC\BZBUTADJ.PDF, or by pressing the "Plain Text" button.

We have added the toxics data from the Bay Area Air Quality Management District (BAAQMD) as a convenience to users, and the inclusion of these data does not imply that the Air Resources Board makes any endorsement of the quality of these data. Any questions about the quality of the BAAQMD toxics data should be directed to the BAAQMD. For more information, see the notes in the text file CAUTIONS.PDF, which is located in the D:\DOC directory, or by pressing the "Plain Text" button.

The statewide summary statistics (California, California Maximum, or California-Daily Highest Value) only include California sites and exclude “Mexico”, “Outside of California”, and “Nevada” for both criteria and toxics pollutants. Available criteria pollutant annual statistics for “Mexican” sites,“Outside of California” sites, and “Nevada” sites are viewable in the "Annual Data" reports by selecting the option to see data for a single basin and then picking “Mexico” or “Outside of California”, or for a single ozone 8-hour planning area and then picking “Mexico” or “Nevada.”

Caution should be exercised when comparing Toxics data with NMOC data. Toxics gases units are in ppbV and NMOC units are in ppbC. The conversion from ppbV to ppbC is based upon the formula: (ppbV) X (number of carbons in the compound) = ppbC

More information about NMOC or PAMS compounds can be found in the document D:\DOC\NMOCDATA.PDF or by pressing the "Plain Text" button or by connecting to the Internet http://www.arb.ca.gov/aaqm/hcarbons.htm. For NMOC Limits of Detection

(LODs), refer to D:\DOC\NMOCLODS.PDF.

X. Direct Extraction of Annual and Daily Data

Users can make their own extractions of annual and daily data from files on the CD. The ACCESS and some DBF files on the CD are not compressed and can be used directly by a variety of database management products. Microsoft ACCESS can attach or link to either the ACCESS files or DBF files. Foxpro and other software (e.g. SAS) can open or use data in the DBF files.

Besides the basic annual and daily data files on the CD, users making their own extractions may want to use information in the LOCATION, VARIABLE, and BASINS files or tables. These files/tables contain additional information related to the data in the basic data files. Some of the daily files on the CD are quite large. Users may want to select data of interest based on location, variable, year, date, day-of-week, or 1 character air basin code fields in the basic data files. The extracted data could then be processed further on the user's PC. Users extracting data from the DBF files should read the section on "Using Numbers Stored As Text."

XI. Extraction of Basin and County Summary Statistics

Included within the daily data files are California daily high and air basin daily high statistics. Included within the annual data files are California, air basin, or county (portion of air basin) statistics. To extract these summary statistics and not the statistics for individual monitoring sites, users can select only data records with location codes that are non-numeric. In Foxpro or ACCESS, this is easily done by selecting records with Location > '9999'. This excludes monitoring sites, which have location codes less than 9999. Further selection of summary statistics can be accomplished by linking the data to the LOCATION data file and using the contents of the Summary Level (or Summarylvl) field to select State (S), Basin (B), County (C), or ozone 8-hr planning areas (P) statistics.

XII. Using Numbers Stored As Text

On this CD, data in DBF files are stored as text. This allows zero values to be differentiated from missing data (null values). When the DBF files are used directly, techniques for converting the text values to numbers may be useful. The following are some techniques that might be used:

1. DBF and ACCESS Files - Several approaches are possible. First, the structure of the data fields for the file could be changed from character to numeric. This may cause missing values to be displayed as zeros. Second, only those values that are not missing could be converted to numbers. Selection of data values could be done with the condition LEN(LTRIM(<data field>)) > 0. Conversion to numbers could be accomplished with VAL(<data field>). In both cases <data field> is the name of the data field being converted.

2. Quattro Pro(or WK1) Files - You can use @IF(@ISSTRING(<Cell>),@VALUE(<Cell>),"") to convert the contents of cell, <Cell> , to either a value or null, "".

3. XLS Files - You can use IF(ISBLANK(<Cell>),"",+VALUE(<Cell>)) to convert the contents of cell, <Cell> , to either a null, "", or value.

XIII. Getting Help

Helpful information is contained in a number of documents in the \DOC\ subdirectory of the CD or by pressing the "Plain Text" button.

XIV. Contact and Feedback

If you have problems with this CD, please call or E-mail the following:

Bob Weller (916) 322-6158 aqdcd@arb.ca.gov

We also welcome your feedback or suggestions on improvements to this CD.

XV. Acknowledgments

This CD was produced by the Community Assessment and Statistical Analysis Section of The California Air Resources Board, Planning and Technical Support Division, Air Quality Data Branch. Many people contributed to this CD. Bob Weller under the direction of Mena Shah, manager of the Community Assessment and Statistical Analysis Section performed the principal effort in preparing the data files and assembling the CD. Gary Knops, Rick Hansen, Theresa Clark-Sjaaheim, and Steve Kuns of the Office of Information Services and Li Fitzmaurice of the Community

Assessment and Statistical Analysis Section produced many of the programs for the data files. Mike Redgrave of the Air Quality Data Section produced the Toxics files and the particulate matter (PM10, PM2.5, and Dichot) files. Rich Bradley developed some of the annual and daily reports, and graphics capabilities. Bob Weller updated and modified the annual and daily reports and programs. Rich Bradley supplied technical expertise and guidance for the CD programs. Greg O'Brien guided the development process from Access 2 to Access 2000 and supplied servers for development. Susana Contreras and Gary Mann helped test the programs on the CD. Jeff Austin of the Community Assessment and Statistical Analysis Section and Mike Redgrave developed programs to reformat some of the data. Rajinder Sahota of the Community Assessment and Statistical Analysis Section helped review the documentation. The cover design was by Paul Cox of the Air Quality Analysis Section. The CD label design was by Bob Weller.

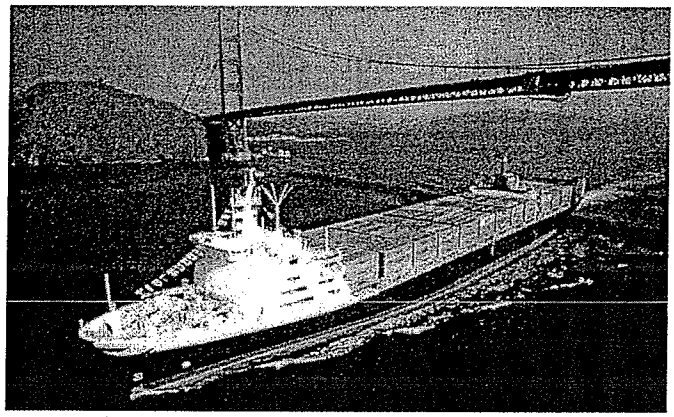
XVI. Contents of Data Files

In a separate file, FILE06CD.PDF is a list of data files on the CDs and the variables included in them. If you print the FILE06CD.PDF file in the \DOC subdirectory, or press the "Plain Text" button, the list should serve as a handy reference or Table of Contents of the CD.

California Environmental Protection Agency

AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING



PROPOSED REGULATION FOR AUXILIARY DIESEL ENGINES AND DIESEL-ELECTRIC ENGINES OPERATED ON OCEAN-GOING VESSELS WITHIN CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE

Stationary Source Division
Emissions Assessment Branch
October 2005

Appendix F

Offshore Emissions Impacts on Onshore Air Quality

OFFSHORE EMISSIONS IMPACTS ON ONSHORE AIR QUALITY

The transport of air pollution over long distances and between air basins is well established. The emissions from ocean-going vessels (OCVs or vessels) can travel great distances and numerous studies have shown local, regional, and global impacts on air quality. (Endresen, 2003; Jonson, 2000; Corbett and Fishbeck, 1997; Streets, D.G., 2000; Saxe, H. and Larsen, T., 2004) Ocean-going vessels emit large quantities of several pollutants, however, the impacts of nitrogen oxides (NOx) and sulfur oxides (SOx) are the most often studied using various air quality models. In a recent study, using a bottom-up estimate of fuel consumption and vessel activity for internationally registered fleets, annual emissions from vessels worldwide were estimated to be significantly greater that previously considered. This study estimated that the global NOx from vessels is actually more than doubled from previous estimates. This study also suggests that near shore emissions impacts may be much larger than previously estimated. (Corbett and Koehler, 2003) Other studies indicate that vessel emissions can be a dominant contributor to sulfur dioxide concentrations over much of the oceans and in many coastal regions. (Capaldo, 1999) However, NOx and SOx are not the only pollutants of concern, as additional studies show coastal ozone and particulate matter impacts from OCV emissions. (Marmer and Langmann, 2005; Lawerence and Crutzen, 1999; Fagerli and Tarrasson, 2001; Eastern Research Group and Starcrest Consulting Group, 2003)

A study for the International Maritime Organization concludes that at any given time, most vessels are near a shore and that approximately 80 percent of the emissions are emitted near the coast, including the west coast of the United States. (International Maritime Organization, 2000) In California, ship emissions are becoming an increasingly important source of emissions as their relative contributions to the total amount of pollution is increasing as land based sources become more stringently controlled. For example, the Santa Barbara County Air Pollution Control District estimates that by 2015, NOx emissions from ships will comprise more than 60 percent of their total NOx inventory. (Murphy)

The issue of onshore impacts of offshore emissions has been a concern in California for several decades. Tracer studies, analysis of meteorological data and ambient monitoring data, and air quality modeling, are approaches used to determine the extent to which emissions released offshore can impact onshore areas.

Tracer Studies

Tracer studies have been conducted off the California coast to determine characteristics of pollutant transport in California's coastal areas and they provide evidence of onshore impacts from offshore emissions. A tracer study involves the release of a known amount of a non-toxic, inert gas from either a moving or

fixed point offshore and the subsequent sampling the of the atmosphere for concentrations of that gas at sites onshore. Brief descriptions of three such studies, from which we can infer that pollutants emitted from offshore ships can be transported to onshore areas and be available to participate in onshore atmospheric processes, are given below.

In 1977, a dual tracer study was conducted from a naval research vessel traveling 8 to 20 miles offshore. (ARB, 1983) The two tracers, sulfur hexafluoride and bromotrifluromethane were released as the ship moved from the Long Beach area to the Santa Barbara channel. Twenty-nine onshore sites were established to monitor for the two tracers. The results showed both tracer gases were detected at sampling stations along the entire length of the network that ran from Ventura to Long Beach.

Another tracer study involving the Santa Barbara Channel conducted in 1980 was performed to collect data to be used in an air quality model and again showed pollutants emitted offshore were detected onshore. (ARB 1982; ARB 1984) This study used sulfur hexafluoride in six tracer experiments emitted offshore and at Point Conception. Over 10,000 samples were gathered from on-shore sites and also from boats and airplanes to determine offshore transport paths. The results showed that pollutants emitted in the Santa Barbara Channel will be transported onshore and that very little dispersion occurs over water, and as a consequence, the pollutant concentration downwind can be elevated.

The most recent of the tracer studies discussed here was conducted as part of the 1997 Southern California Ozone Study. (ARB, 2000) The objectives of this tracer study were two-fold. The primary objective was to obtain direct evidence regarding the trajectory of emissions from vessels transiting the coast and the impact on onshore air quality from two proposed shipping lanes. The secondary objective was to assess the ability of models to simulate the relevant physical processes that take place during transport of emissions offshore from the shipping lanes to onshore. A total of 51 onshore sampling site locations were selected from Santa Barbara to Oceanside, going inland as far as Santa Clarita Valley and the Rubidoux air monitoring station. Five perfluorocarbon (PFTs) tracers were used in this study. The tracer gases were released from both a fixed point offshore and from vessels moving simultaneously along two shipping lanes for a specified period of time. The results of the study showed that the tracer gases were detected on-shore and suggested that meteorology strongly influences the direction and magnitude of dispersion of the pollutants.

Meteorology/Climatology

Another source of information regarding onshore impacts is to examine the meteorology/climatology near the coast. In the early 1980's, based on a investigation of meteorological data, the Air Resources Board established the California Coastal Waters (CCW) as a boundary within which emissions that are

released, are transported on-shore. In addition, ARB meteorology staff recently reviewed available data to determine if California meteorological and climatology support the transport of offshore emissions to coastal air basins. A brief discussion on the development of the CCW and the more recent data review is presented below.

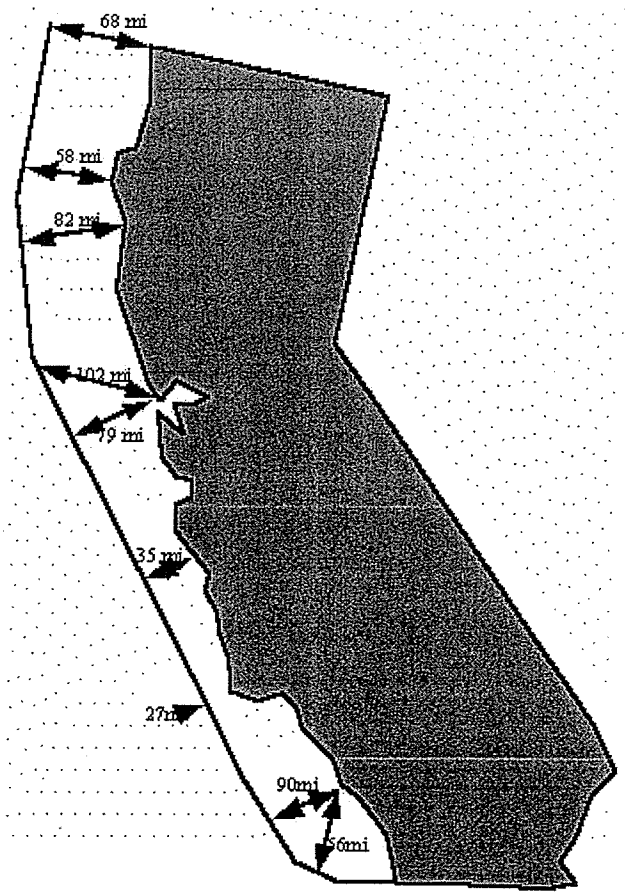
California Coastal Water Boundary: Previous studies by the ARB have demonstrated that pollutants released off California's coast can be transported to inland areas due to the meteorological conditions off the coast. In 1983, in the Report to the Legislature on Air Pollutant Emissions from Marine Vessels, the ARB established a boundary based on coastal meteorology within which pollutants released offshore would be transported onshore (ARB, 1983; ARB, 1984). The development of the boundary defined as the California Coastal Waters (CCW) is based on over 500,000 island, shipboard, and coastal observations from a variety of records, including those from the U.S. Weather Bureau, Coast Guard, Navy, Air Force, Marine Corps, and Army Air Force. (ARB, 1984) The area within the CCW boundary is defined as that area between the California coastline and a line starting at the California Oregon border at the Pacific Ocean. The California Coastal Waters are shown in Figure 2. This boundary ranges from about 25 miles off the coast at the narrowest to just over 100 miles at the widest.

Figure 2: California Coastal Waters

"California Coastal Waters" means that area between the California Coastline and a line starting at the California-Oregon border at the Pacific Ocean

thence to 42.0°N 125.5°W
thence to 41.0°N 125.5°W
thence to 40.0°N 125.5°W
thence to 39.0°N 125.0°W
thence to 38.0°N 124.5°W
thence to 37.0°N 123.5°W
thence to 36.0°N 122.5°W
thence to 35.0°N 121.5°W
thence to 34.0°N 120.5°W
thence to 33.0°N 119.5°W
thence to 32.5°N 118.5°W

and ending at the California-Mexico border at the Pacific Ocean. Coordinates shown above are exact. Distances of California Coastal Waters boundary from coast are rough



approximations.

Review of Available Meteorological and Climatological Data: As previously documented in reports by the ARB (ARB, 1983; ARB 1984) the lower atmosphere is the medium in which air pollution is carried from one surface or near-surface pollution source to a surface based receptor. In this medium, the direction of pollution transport and the dispersion of air pollutants are largely dependent upon the wind and the vertical temperature distributions (stability).

The wind and the stability along the coast of California are largely affected by the North Pacific high pressure cell, particularly during the summer. It is a semi-permanent feature of the Northern Hemispheric large scale atmospheric circulation pattern, and it produces a predominantly northwesterly flow of maritime air over the California coastal waters. This circulation pattern is modified to more westerly flow by continental influences as the air approaches the coast of California.

Another California weather characteristic that results from the location of the Pacific high is the steady flow of air from the northwest during the summer that helps drive the California Current of the Pacific Ocean. The California Current sweeps southward almost parallel to the California coastline. However, since the mean drift is slightly offshore, there is a band of upwelling immediately off the coast as water from deeper layers is drawn into the surface circulation. The water from below the surface is colder than the semi-permanent band of cold water just offshore, which ranges from 25 to 50 miles in width.

The temperature of water reaching the surface from deeper levels is as much as 10° colder during the summer than is the water 200-300 miles farther west. Comparatively warm, moist Pacific air masses drifting over this band of cold water form a bank of fog which is often swept inland by the prevailing northwest winds out of the high pressure center. In general, heat is added to the air as it moves inland during these summer months, and the fog quickly lifts to form a deck of low clouds that extend inland only a short distance before evaporating completely. Characteristically, this deck of clouds extends inland further during the night and then recedes to the vicinity of the coast during the day. This layer of maritime air is usually from 1,000 to 2,000 feet deep, while above this layer the air is relatively warm, dry, and cloudless.

Additionally, the air flowing around the Pacific high at upper levels is sinking (subsiding) and consequently warming due to compression. This warm air above the cool coastal marine air produces a strong, persistent vertical temperature inversion which limits the vertical mixing of pollutants.

As stated above, the North Pacific high pressure cell produces a predominantly northwesterly flow of marine air over California Coastal Waters and, generally, this flow becomes more westerly as the air approaches the coast of California.

Numerous climatological studies which describe the air flow patterns along the California coast clearly show this. Table 1 presents a summary of the wind flow direction frequencies measured at various locations along the California coast as shown in previous ARB reports. The table shows that onshore wind flow predominates during the spring and summer at all five locations, and during the fall at four out of the five sites. The table also shows that, on an annual basis, onshore winds are about twice as common as offshore winds at those given locations. The data in Table 1 are based on a relatively large data set. Because the data set covers multiple years, these wind flow percentages are not expected to change significantly over time. However, data from a more recent analysis are provided in Table 2 to show the consistency in wind flow patterns through the years. Table 2 shows the predominant wind flow at various coastal sites in California. The directions that are shaded correspond to onshore conditions. All coastal sites depicted in this table are dominated by onshore conditions and each site has at least eight months where onshore flow is the dominant wind direction. The data in Table 2, although depicted slightly different, are consistent with the data in Table 1.

Table 1: Wind Flow Direction Frequencies in Coastal Areas of California[1]

Station	Wind Direction	Seasonal Frequency[2] (%)				
		Spring	Summer	Fall	Winter	Annual
Oakland	Onshore	75	83	62	47	67
	Offshore	20	13	27	42	25
	Calm	5	4	11	11	8
Vandenberg AFB	Onshore	64	69	48	34	54
	Offshore	24	9	32	53	29
	Calm	12	22	20	13	17
Santa Barbara	Onshore	50	62	44	32	47
	Offshore	26	21	29	24	25
	Calm	24	17	27	44	28
Point Mugu NAS	Onshore	57	59	41	31	47
	Offshore	28	21	41	54	36
	Calm	15	20	18	15	17
Los Angeles	Onshore	68	81	60	43	63
	Offshore	30	16	36	53	34
	Calm	2	3	4	4	3

Source: National Climatic Center
1. Period of Record:
Oakland – 1965-1978
Vandenberg AFB – 1959-1977
Santa Barbara – 1960-1964
Point Mugu NAS – 1960-1972
Los Angeles International – 1960-1978

2. Spring: March, April, May;
Summer: June, July, August;
Fall: September, October, November; and
Winter: December, January, February

Table 2: Prevailing Wind Direction at California Coastal Sites[1] (1992-2002)

Station[2]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SFO	W	W	W	W	W	W	W	W	W	W	W	W
MRY	ESE	ESE	W	WNW	W	W	W	W	W	W	ESE	ESE
SBA	WSW	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW
OXR	W	W	W	W	W	W	W	W	W	W	W	NE
NTD	NE	W	W	W	W	W	W	W	W	W	NE	NE
SMO	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	N
LAX	E	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	E
SNA	S	S	S	S	S	SSW	SSW	SSW	SW	SW	SW	S
OKB	W	NE	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	NNE
SAN	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW

Source: Western Region Climate Center (http://www.wrcc.dri.edu/)

[1] Prevailing wind direction is based on the hourly data from 1992-2002 and is defined as the direction with the highest percent of frequency. Wind directions that are shaded correspond to onshore flow.

[2] SFO – San Francisco International Airport; MRY – Monterey Airport; SBA – Santa Barbara Airport; OXR – Oxnard Airport; NTD – Point Mugu Naval Air Station; SMO – Santa Monica Airport; LAX – Los Angeles International Airport; SNA – Santa Ana Airport; OKB – Oceanside Municipal Airport; SAN – San Diego Lindbergh Field

As stated above, the large scale climatological wind flow along the California coast is modified by the effects of local land/sea breeze circulations. In effect, the local daytime sea breeze enhances the large-scale onshore component of the wind while the nighttime land breeze retards or occasionally reverses the flow. Table 3 presents seasonal resultant winds by time of day for San Francisco International Airport and Point Mugu Naval Air Station. The table shows the influences of the land/sea breeze circulations and shows that the onshore winds are generally stronger than offshore winds, a further indication of the transport of offshore emissions to receptor areas onshore.

Table 3: Seasonal Resultant Winds
(Degrees/MPH – Onshore Winds Shaded)

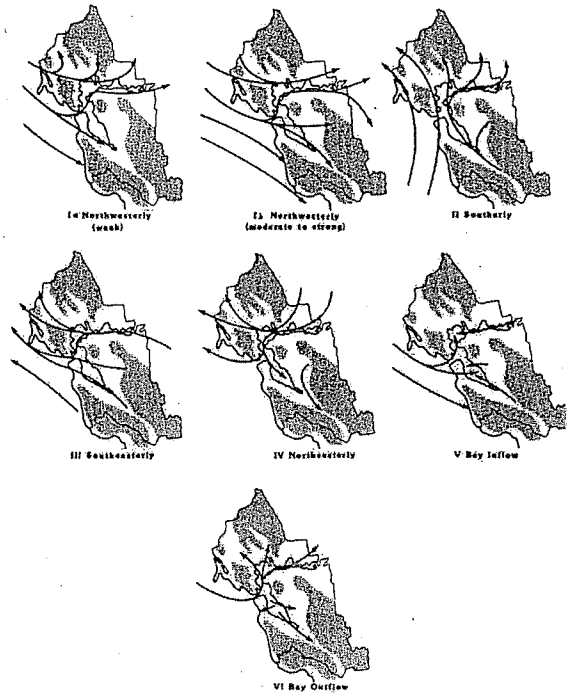
	San Francisco (International Airport)						Point Mugu NAS				
Time (PST)	Spring	Summer	Fall	Winter	Annual		Spring	Summer	Fall	Winter	Annual
0100	277/7.2	287/9.4	281/4.7	252/1.7	280/5.7		323/1	Calm	036/2	033/4	024/1
0400	272/5.7	284/8.0	278/3.7	224/1.1	276/4.5		007/1	029/1	032/2	036/4	030/2
0700	274/4.1	282/6.2	270/2.6	180/1.4	271/3.2		013/2	013/1	031/2	038/4	029/2
1000	305/4.1	306/7.2	350/2.0	084/2.1	320/2.9		230/4	235/5	210/1	052/4	230/2
1300	288/10.7	297/15.3	307/6.2	015/1.7	299/8.1		250/8	252/8	248/5	230/2	249/6
1600	281/15.0	289/17.9	293/10.4	299/3.9	288/11.7		264/9	267/8	269/6	279/3	268/7
1900	281/13.2	289/15.3	289/9.9	282/4.0	286/10.6		279/5	287/4	320/2	001/2	297/3
2200	280/9.4	289/11.5	287/6.2	266/2.6	284/7.4		297/2	291/1	002/2	022/3	340/2
All Hours	281/8.6	291/11.3	291/5.8	276/1.3	287/6.7		269/3	264/3	300/1	022/2	288/2

In addition, the ARB staff categorizes air flow for the four most heavily populated air basins in California: Sacramento Valley, San Joaquin Valley, San Francisco Bay Area, and the South Coast Air Basin three times a day. See Figure 1 for an example of the air flow types relevant to the San Francisco Bay Area and South Coast Air Basins.

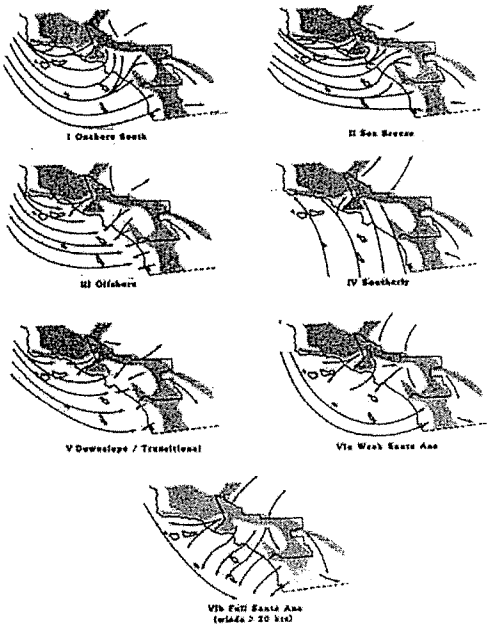
Onshore and offshore percentages can be obtained by grouping the types appropriately. For instance, air flow types Ia, Ib, II, V, and VI would correspond to onshore conditions in the San Francisco Bay Area. Air flow types I, II, and IV would reflect onshore conditions in the South Coast Air Basin. The results are illustrated in Table 4. The onshore/offshore prevalence for these air basins based on this kind of air flow typing is consistent with the onshore/offshore frequencies of individual sites in these areas shown from prior analyses.

Figure 1

San Francisco Bay Area Air Basin



South Coast Air Basin



Period of Record: San Francisco International 1975-1979
Point Mugu NAS 1962-1977

Source: National Climatic Center

The air that flows around the Pacific high at upper levels sinks (subsides) and consequently warms due to air compression. This warm air above the cool coastal marine air produces a strong and persistent vertical temperature inversion that is a major influence on atmospheric stability. Atmospheric stability is the primary weather factor that influences the vertical dispersion of pollutants. In general, the more stable the air, the more dispersion is inhibited. An extremely stable subsidence inversion dominates the California coastal areas and effectively caps the marine layer, providing a ceiling above which pollutants cannot rise. This reduces the vertical dispersion of air pollution, particularly during the summer when the inversion is strongest and most persistent.

Table 4: Composite Surface Air Flow Types (1977-1981)

San Francisco Bay Area Air Basin					South Coast Air Basin		
Season	**Onshore**	**Offshore**	**Calm**		**Onshore**	**Offshore**	**Calm**
Winter	59	25	14		38	45	16
Spring	88	7	5		64	27	9
Summer	96	1	3		73	16	11
Fall	80	10	9		53	34	13
Yearly	81	11	8		58	30	12

Source: California Air Resources Board , California Wind Climatology (June 1984)

Table 5 is a compilation of seasonal inversion frequencies and characteristics for Oakland, Vandenberg AFB, and Point Mugu NAS. The table shows that the mean height of the base of the subsidence inversions ranges between 600 and 2200 feet above sea level (asl) and is persistent throughout the year. (Inversions are present some 90 percent of the time.) The combination of a strong, persistent inversion and the onshore winds which characterize the coastal meteorology of California is conducive to the transport of offshore emissions to coastal air basins. Offshore emissions are transported beneath or within the inversion, with little dispersion, to onshore areas.

Table 5: Atmospheric Inversion Statistics 1975-1977

Oakland					
	Spring	Summer	Fall	Winter	Annual
Mean					
Invers. Top (ft asl)	3200	2800	2900	3000	3000
Invers. Base (ft asl)	2200	1200	1700	1900	1700
Strength	6	15	8	6	9
Percentage of Occur.					
Inversion	80	98	88	80	86
Base <= 3000' asl	58	94	71	60	71
Base <= 1000' asl	31	47	44	43	41
Vandenberg AFB					
	Spring	Summer	Fall	Winter	Annual
Mean					
Invers. Top (ft asl)	2900	3200	2700	2600	2900
Invers. Base (ft asl)	1700	1400	1400	1600	1500
Strength	10	20	12	8	13
Percentage of Occur.					
Inversion	89	99	93	85	92
Base <= 3000' asl	77	96	85	71	83
Base <= 1000' asl	40	32	50	55	44

Point Mugu NAS					
	Spring	Summer	Fall	Winter	Annual
Mean					
Invers. Top (ft asl)	1900	2800	2000	1400	2100
Invers. Base (ft asl)	1100	1300	1000	600	1000
Strength	7	14	10	8	10
Percentage of Occur.					
Inversion	84	99	96	87	92
Base <= 3000' asl	73	93	86	83	84
Base <= 1000' asl	57	47	66	68	59

Other Studies

Establishing the distance of how far offshore pollutants can be emitted and will have an expected onshore impact is dependent upon the models used and meteorology of the coastal area. For the development of emission inventories, U.S. EPA has investigated the extent to which emissions offshore have the potential to impact onshore air quality and taken that into consideration when developing emission inventories. Studies have also been conducted that investigate the over-water chemistry of ship emissions and how that may influence air quality models. In addition, information on the contribution of ship emissions impacts was evaluated from air monitoring data collected in Southern California during the strike of union workers at the Ports of Long Beach and Los Angeles. These are discussed briefly below.

For ocean-going vessels, the United States Environmental Protection Agency (USEPA) counts NOx emissions in their inventory if the vessel is operating within a 175 nautical mile boundary off of the United States coasts. (USEPA, 2003) As stated in the Support Document for Controlling Emissions from New Marine Engines at or above 30 liters per Cylinder, "this 175-mile area is based on the estimate of the distance a NOx molecule could travel in one day (assuming a 10 mile per hour wind traveling toward a coast, NOx molecules emitted 12 miles from the coast could reach the coast in just over one hour. NOx molecules emitted 175 miles, or 200 statue miles, could reach the coast in less than a day.)" Also mentioned in this report was a modeling study conducted by the Department of Defense That concluded that emissions released within 60 nautical miles of shore could make it back to the coast. (Eddington, 1997) In response to a request by the USEPA for comment on this 175-mile boundary, a study using 10 years of hourly surface wind data was performed to estimate the probability that offshore emissions will impact land from specified distances. (Eddington and Rosenthal, 2003) This study showed that for California, the probabilities were high (greater than 80 percent) that emissions from 50 nautical miles offshore will reach the coast within 96 hours.

There has been very little actual in-transit measurement of the pollutant emissions from ships to better understand various aspects of ship plume chemistry and reconcile differences between measurements and model predictions. However, a recent study conducted by Chen et al (Chen, 2005), where measurements of chemical species in ship plumes were taken from aircraft transecting a ship plume indicates that the NOx half-life within a ship's plume may be much shorter than predicted by photochemical models. The study demonstrated a NOx lifetime of about 1.8 hours inside the ship plume at noontime as compared to about 6.5 hours in the background marine boundary layer of the experiment. Additional studies investigating ship plume chemistry will help validate these results and help us better understand ship plume chemistry and improve the photochemical models used to investigate the impacts of ships on air quality.

Recently, a study was conducted that investigated ambient air quality data to examine contributions from ship emissions. In the fall of 2002, union workers at the ports of Los Angeles and Long Beach went on strike. The result was that the port operations shut down and about 200 ships were idling off the coast, immediately upwind of Long Beach. As part of a study in support of the University of Southern California Children's Health Study, researchers analyzed the effect of this strike on PM and gaseous pollutants at a monitoring site in Long Beach. Based on a comparison of PM and gaseous pollutant measurements from pre-, during and post-strike periods, they found statistically significant increases in particle number concentrations (60-200nm) and NOx and CO which they concluded are indicatives of contributions of emissions from the idling ships during the strike period. (ARB, 2005)

Conclusions

The transport of air pollution over long distances and between air basins has been well established. The emissions from ocean-going vessels can travel great distances and numerous studies have shown local, regional, and global impacts on air quality. Tracer studies, air quality modeling, and meteorological data analysis are typical approaches used to determine the extent to which emissions released offshore can impact onshore areas. Several studies support ARB staffs conclusion that emissions from ocean-going vessels released offshore the California Coast can impact onshore air quality.

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(ARB, 1984) *Report to the California Legislature on Air Pollutant Emissions from Marine Vessels*, Appendices H to M, Volume VII; June 1984.

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